

drawings and underlining in the columns. Applicant is mindful of the requirement to be fully responsive to the Office Action (37 C.F.R. §1.111). However, there are no indications in the Examiner's Office Action Summary or in the Detailed Action memorandum that these handwritten notations are material to the Examiner's communication in this Office Action. Therefore, applicant is not responding to handwritten notations in the Office Action copies of Lin and Inohara et al. as received.

I. Claim Rejections under 35 USC §112

A. The Examiner rejected claims 1-32 "under 35 USC §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention."

B. Regarding claim 1 the Examiner states that the term "etch" in "the first etch mask" (clause e) lacks an antecedent basis. Applicant has amended clause e of claim 1 by removing the term "etch".

C. Regarding claims 1, 14 and 19 the Examiner states that the term "predetermined" renders the "process claim unclear in meaning in scope". Applicant has amended claim 1 at clauses c and g; claim 14 at clauses a and b, and claim 19 at clauses c and g, by removing the term "predetermined".

D. Regarding claims 13 and 16-18, applicant respectfully submits that the "predetermined" term is not recited in these claims and is not included in these claims due a claim dependency from an antecedent claim having the term "predetermined". Applicant therefore respectfully submits that the Examiner's rejection of claims 13 and 16-18 under 35 USC §112, second paragraph, is inappropriate.

E. Regarding claim 31. Applicant has amended claim 31 by removing the term "predetermined" although the Examiner did not specifically reject claim 31 under 35 USC §112.

In view of the amendments to claims 1, 14, 19 and 31, and the arguments set forth above, applicant believes that claims 1, 5, 19 21 and 23-32 are in a condition for allowance under 35 USC §112, second paragraph.

II. Claim Rejections under 35 USC §102

A. The Examiner rejected claims 1-5, 7-9, 11-12 “under 35 USC 102(e) as being anticipated by Inohara et al. (U.S. 5,976,972).”¹

Regarding amended claim 1. The ‘972 patent (Inohara et al.) discloses method steps for sequentially depositing a cap layer 54, a first dielectric layer 43 and a second dielectric layer 44 on a substrate. A first etch mask including a via pattern is formed on the second dielectric layer. The via pattern is etched through the second dielectric layer. A third dielectric layer 45 is formed on the second dielectric layer and a trench is fabricated in the third dielectric layer. By contrast, applicant sequentially forms first and second dielectric layers on a substrate without interposing a cap layer between the first dielectric layer and the substrate. The ‘972 teachings form the via hole through the first dielectric layer and the cap layer, see col. 13 lines 19-23 and lines 49-53. On the other hand, applicant’s via hole that extends to the substrate is not formed through a cap layer. Also, while the bottom of the ‘972 trench (i.e. wiring groove 46) is separated from the substrate by two layers (i.e. layers 54 and 43) see for example ‘973 Fig. 31, the bottom of applicant’s trench is separated from the substrate by only one layer (i.e. the first dielectric layer, see clause h-j).

Support for the amendment is found in claim 2 as filed (now cancelled), the specification at page 13 lines 1-7 and Figs. 6A and 6B.

¹ Examiner’s Detailed Action memorandum, p.3, item 3

It is well established that claim anticipation under 35 USC §102(e) requires identity of invention in a single reference. “To anticipate a claim, the reference must teach every element of the claim”, see MPEP §2131.

For the reasons stated above, applicant believes that amended claim 1 is not anticipated by Inohara, and that amended claim 1 is therefore in a condition for allowance under 35 USC §102(e).

Regarding claims 5, 7-9 and 11-12. Claim 11 has been amended to depend from amended claim 1, rather than from now cancelled claim 2 which has been incorporated into claim 1. Claims 5, 7-9 and 11-12 depend from amended claim 1. Applicant believes that amended claim 1 is in a condition for allowance, as reasoned above. Applicant therefore believes that claims 5, 7-9 and 11-12 are in a condition for allowance under 35 USC §102(e).

B. The Examiner rejected claims 13, 16-18 “under 35 USC 102(e) as being anticipated by Inohara et al. (U.S. 5,976,972)”.²

Regarding amended claim 13. The Examiner states with reference to the ‘972 patent that:

“Innohara (sic) et al, figs 35-40 col 14 lines 30-67 and col 15, discloses the claimed method of forming a structure on a substrate comprising steps: forming a dielectric stack (54, 43, 44, fig 37) including an etch stop layer (44, SiN); forming a sacrificial etch segment, a first trench and a second trench on the etch stop [the sacrificial etch segment, first trench and second trench are located in the split region 51 in fig 39] such that the sacrificial etch segment is position (sic) between the first and second trenches;”³

Applicant notes that the ‘972 trenches are located in the ‘972 split region, see the above quoted Examiner’s statement and also see the ‘972 patent at col. 15 lines 15-17 “The grooves 46 include a region overlapping the slit region.” By contrast, applicant’s

² *Id.* at p. 4, item 4

³ *Id.*

amended claim 1 recite the limitation of forming trenches that do not overlap the sacrificial etch segment, see clauses d and e.

Support for the above described amended limitation is found in the specification at page 15 line 31 through page 16 line 2.

In view of the amendment to claim 13 and the reasons stated immediately above, applicant believes that amended claim 13 is not anticipated by Inohara et al.

Regarding claims 16-18. Claims 16-18 depend from amended claim 13. Applicant believes that amended claim 13 is not anticipated by Inohara et al., as reasoned above. Applicant therefore believes that claims 16-18 are not anticipated by Inohara et al.

C. The Examiner rejected “claims 13-14, 16-23 and 28-30 “under 35 USC 102(e) as being anticipated by Lin [US 6,093,632].”⁴

Regarding amended claim 13. The Examiner includes the following statement with reference to the ‘632 patent:

“depositing a first mask layer (11, fig 5) on the second dielectric layer wherein the first mask layer includes: (1) a first via pattern having a width T, (2) a second via pattern and (3) a sacrificial etch pattern positioned between the first and second via patterns such that the sacrificial etch pattern has a width W; anisotropically etching the first and second via patterns through the second dielectric layer and forming a sacrificial etch segment by simultaneously etching the sacrificial etch pattern through the second dielectric layer [see fig 5-6].”⁵

The above quoted Examiner’s statement refers to ‘632 Figs. 5 and 6. With reference to Fig. 5, the ‘632 patent discloses that “photoresist shape 11 with opening 12a, is next formed . . . creating small area, silicon nitride islands 10b, schematically shown in Fig. 5.”, see col. 5, lines 29-43. Opening 12a is defined as “the space between silicon

⁴ *Id.*, at page 5, item 5

⁵ *Id.*

nitride islands, which will sequentially translate to the diameter of the narrow diameter opening, of the dual damascene opening”, see col. 5, lines 39-43. A review of Figs. 5, 6 and 7 shows that space 12a of Fig. 5 does not overlay metal interconnect structure 2, while space 12a of Fig. 6 overlays interconnect structure 2. Applicant believes that space 12a of Fig. 5 does not form or indicate a via opening, while space 12b of Fig. 6 might appear to subsequently include an opening. If such an opening were created subsequently, it would mean that the opening is not formed in photoresist shape 11. Therefore, applicant respectfully submits that the ‘632 patent teaches that spaces which are formed in photoresist shape 11 are spaces between islands. This is contrary to what applicant believes to be the Examiner’s assertion, i.e. that some of the spaces are spaces between islands and that other spaces are via openings or via masks. Amended claim 13 provides the limitation that the sacrificial etch mask as well as the first and second via masks are formed in the mask layer overlaying the etch stop layer, while there is no indication or suggestion in the ‘632 teachings that a via mask is formed in the mask layer that includes the sacrificial etch mask.

Also, the ‘632 patent teaches at col. 5 lines 54-61, that a narrow diameter opening 12b is created “in second silicon oxide layer 4, using opening 12a, located between small area, silicon nitride islands 10b as a mask.” As stated above, applicant believes that the ‘632 patent teaches that the spaces in photoresist 11 are spaces between islands (see for example col. 5 lines 29-43). If opening 12b were utilized without further modification as an etch mask, the result, in applicant’s opinion, would be a trench rather than a via hole. In this context, applicant believes that opening 12b is a trench mask rather than a via mask.

Additionally, the ‘632 patent teaches forming a trench through the “regions of small area, silicon nitride islands 10b,” (col. 6, lines 3-6), while applicant forms the trench on the etch stop layer that includes the sacrificial etch segments (clause d).

Support for the amendment to claim 13 is found in the specification at page 14 lines 12-29 and Figs. 8A-8C and claim 19 as filed.

For the reasons stated above, applicant believes that amended claim 13 is not anticipated by Lin and that amended claim 13 is therefore in a condition for allowance under 35 USC §102(e).

Regarding amended claim 14 and claims 16-18. Claims 14 and 16-18 depend from amended claim 13. Applicant believes that amended claim 13 is in a condition for allowance, as reasoned above. Applicant therefore believes that amended claim 14 and claims 16-18 are in a condition for allowance under 35 USC §102(e).

Regarding amended claim 19. Applicant hereby repeats the belief that forming the first mask as recited in clause c, i.e. having first and second via patterns and a sacrificial etch pattern is not anticipated by Lin, as reasoned above in connection with amended claim 13. Furthermore, applicant reiterates the belief that Lin teaches forming a trench through the small area silicon nitride islands while applicant forms a trench on the etch stop layer that includes the sacrificial etch segments, as reasoned above in connection with amended claim 13. Applicant therefore believes that claim 19 is not anticipated by Lin.

Claim 19 has been amended by including the limitations of the now cancelled claim 20.

For the reasons stated above, applicant believes that amended claim 19 is in a condition for allowance under 35 USC §102(e).

Regarding claims 21, 23 and 28-30. Claims 21 and 29 have been amended to depend from claim 19 rather than from now cancelled claim 20. Claims 21, 23 and 28-30 depend from (amended) claim 19. As reasoned immediately above, applicant believes that amended claim 19 is a condition for allowance under 35 USC §102(e). Applicant

therefore believes that claims 21, 23 and 28-30 are in a condition for allowance under 35 USC §102(e).

III. Claim Rejections under 35 USC §103.

The Examiner rejected claims 6, 7, 10, 15, 24-27 and 31-32 “under 35 USC 103(a) as being unpatentable over Lin [US 6,093,632] in view of Inohara et al [5,976,972].”⁶

Regarding claim 31. The Examiner asserts that “it would have been obvious for those skilled in the art to combine the teachings of Inohara et al in the process of Lin to make the width T of the first via pattern exceeding the width P of the first trench pattern by a measure M for making a better dual damascene structure with reasons given above.” Applicant respectfully submits that Lin does not disclose a “first via pattern”, see applicant’s reasoning in Remarks section II,C concerning claim 13. However, it is applicant’s opinion that even if Lin’s opening 12b were a via opening, Lin’s process would employ the step of forming a trench extending through the small area, silicon oxide islands 10b (col. 6 lines 3-6), while applicant’s trench as claimed is formed on the layer that includes the sacrificial etch segment. Applicant respectfully submits that a combination Inohara et al. and Lin, even if possible, would not result in the steps that are employed in forming the claimed structure. Applicant therefore respectfully submits that claim 31 is not obvious in view of Inohara et al. and Lin. Applicant therefore believes that claim 31 is in a condition for allowance under 35 USC §103(a).

Regarding claim 32. Claim 32 depends from claim 31. Applicant believes that claim 31 is in a condition for allowance under 35 USC §103, see immediately above. Applicant therefore believes that claim 32 is in a condition for allowance under 35 USC §103(a).

Regarding claims 6, 7, 10, 15 and 24-27. Claims 6, 7 and 10 depend from amended claim 1. Applicant believes that amended claim 1 is in a condition for allowance, see above. Claim 15 depends from amended claim 13. Applicant believes that amended claim 13 is

⁶ *Id.* at item 6, page 7

in a condition for allowance. Claims 24-27 depend from amended claim 19. Applicant believes that amended claim 19 is in a condition for allowance, see above. Applicant therefore believes that claims 6, 7 10, 15 and 24-27 are in a condition for allowance under 35 USC §103(a).

In view of the above, applicant respectfully submits the claims remaining in the application are in a condition for allowance. The Examiner is invited to call the undersigned in the event the Examiner believes there are any outstanding issues remaining.

Respectfully submitted,

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